



Distribution of fish larvae on the Vitória-Trindade Chain, southwestern Atlantic

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Abstract: This work presents a checklist of ichthyoplankton collected along the Vitória-Trindade chain with oblique bongo hauls to a depth of 20 m in the summer and in the winter. Larvae were classified according the adult habitat as reef, epipelagic or mesopelagic. The variables season, depth, sampling time, environment type and distance from the continental shelf were used to test the correlation with the larval density of each larval category. In the summer, 3,897 larvae were captured (identified at the family, genera or species level, $n = 44, 33$ and 82 , respectively) and 1,026 larvae were captured in the winter (19, 17 and 25, respectively). Only the variables season and environment type significantly affected density, with their influence varying among larval categories.

Key words: plankton, seamounts, Brazil

INTRODUCTION

The Vitória-Trindade chain (VTC) extends for about 1,160 km east off the coast of Espírito Santo state, Brazil. It consists of about 30 seamounts (Motoki et al. 2012), several relatively shallow, reaching depths of less than 50 m. The seamounts Vitória (1,184 km² of plateau above the 120 m isobath), Montague (124 km²), Jaseur

(89 km²), Davis (1,002 km²), Dogaressa (80.5 km²), and Columbia (36.5 km²), as well as the Trindade Island (85 km²) and Martin Vaz Archipelago (24 km²; Figure 1), are the largest and main features of the VTC. These seamounts and islands are separated by bathyal and abyssal depths and distances between 50 and 225 km (Motoki et al. 2012), the latter being the distance between Trindade and Columbia. The VTC and the Abrolhos Shelf are considered, together, a marine area ecologically and biologically significant for conservation (UNEP 2012).

The insular complex Trindade-Martin Vaz (the two islands are separated by less than 50 km) contains 154 fish species (Simon et al. 2013). While 21.6% of coastal fishes of Trindade have a circumglobal distribution, 27.5% are only found in the tropical Atlantic Ocean, 43.1% are restricted to the western Atlantic and 7.8% are endemic to the island complex (Simon et al. 2013). The similarity observed between the ichthyofauna of Trindade and that of the South American coast suggests that reef fishes use seamounts and island of the VTC as stepping-stones (Gasparini and Floeter 2011). Hypothetically, fishes and other organisms would have colonized the summit of seamounts in succession from the initial area of exportation of species (*a priori*, the continental shelf) to the final receiving area (in this case, Trindade and Martin Vaz). Gene flow between

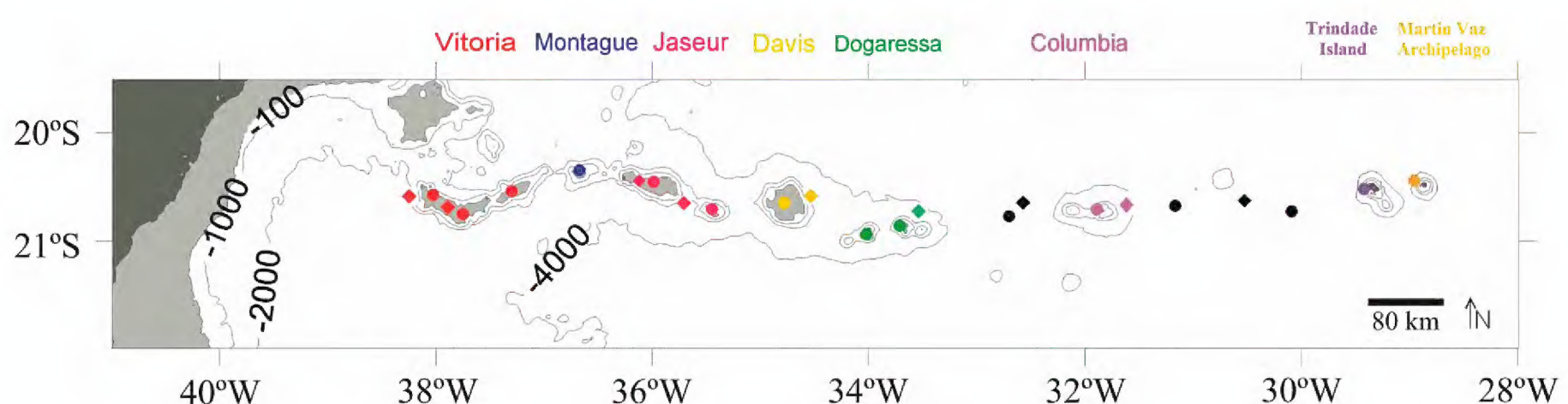


Figure 1. Collection points and locations sampled along the Vitória-Trindade Chain. The circles represent the collections made in summer (December 2011) and the diamonds those made in winter (July 2013). Locations are color-coded. Note that the four collection points near Trindade Island are represented by a single symbol, as are the four points near Martin Vaz Archipelago.

subpopulations could be maintained according to the same scheme (Kimura 1953). Transport over long distances of open sea is made possible by the dispersal ability characteristic of the planktonic phase. For eggs and larvae insufficiently developed, the displacement is entirely passive and promoted by the movement of water masses. Due to their swimming capacity, larvae in the most advanced stages of development are potentially able to position themselves in a particular water mass in which they can be transported or retained (Leis 1991; Huebert et al. 2010). For reef fishes, retention processes are especially important to stay close to the reef (Leis 1991). Epipelagic fish spawn off the coast or near islands, where the larvae can remain to feed (Mather et al. 1995; Alemany et al. 2010; D'Alessandro et al. 2011). Mesopelagic larvae, on the other hand, hatch at great depths and perform vertical migration according to their stage of ontogenic development (Richards 2006).

The study of oceanic ichthyoplankton in the Southeast and South of Brazil has intensified since the 1960s (Katsuragawa et al. 2006) with important works from the Abrolhos Shelf (Nonaka et al. 2000) to Rio Grande do Sul state (Matsuura and Kitahara 1995; Franco and Muelbert 2003), including the Cabo Frio upwelling region (Freitas and Muelbert 2004; Gasalla et al. 2007). Ichthyoplankton surveys on the VTC were conducted before by the REVIZEE program between 1998 and 2000 (Bonecker et al. 2006; Bonecker and Castro 2006; Castro 2006), but this faunal component remains poorly known despite its scientific and biological importance. This work presents a checklist for ichthyoplankton from the VTC and tests the hypotheses that larval density (1) varies between seasons, likely in response to reproductive periodicity; (2) varies with depth according to the habitat used by adults; (3) is higher during the nocturnal period, when occurs the vertical migration; (4) differs among seamount, island and deep ocean because of their distinct oceanographic, chemical and biological aspects; and (5) decreases with distance from the continental shelf following the idea that larval density of topographically associated species often decreases with increasing distance of seamounts from larger land masses (Boehlert and Mundy 1993).

MATERIAL AND METHODS

The ichthyoplankton was collected in summer (December 2011) by NOc Antares and in winter (July 2013) by NHo Cruzeiro do Sul with a bongo net (60 cm aperture, 3 m long and 570 μ m mesh in the cod-end) equipped with a mechanical flowmeter (General Oceanics). A total of 10 locations were sampled: Vitória, Montague, Jaseur, Davis, Dogaressa and Columbia seamounts, Trindade and Martin Vaz islands, and stretches of open ocean between Dogaressa and Columbia and between Columbia and Trindade. Twenty-one stations were sampled in the summer, 13 along the chain, four near Trindade and four near Martin

Vaz (Figure 1). Two hauls were made at each station, resulting in 84 samples. In each haul, one sample was fixed in 10% formalin and the other in alcohol 93%. Nine stations were sampled in the winter (Figure 1) with one oblique haul at each station, resulting in 18 samples that were fixed in alcohol 93%. Hauls in both seasons were oblique to a depth of 20 m, lasted between 10 and 20 minutes and were done at a speed of approximately 2 knots. Depth at station was recorded from the ship's sonar.

Larvae were identified to the lowest taxonomic level as per Fahay (1983), Bonecker and Castro (2006), Richards (2006) and Victor (2012). They were further classified according to the type of habitat occupied by adults (reef, epipelagic and mesopelagic) following Richards (2006) and Froese and Pauly (2012). The reef larvae are those taxa that in the adult phase are associated with the bottom, either reef or marginal areas (e.g., rhodolith beds or sand); the epipelagic larvae contains those pelagic taxa that live in the photic zone of the water column; and the mesopelagic larvae comprise those pelagic taxa that generally occupy the aphotic zone during the day and feed in the upper layers of the water column at night.

The density (larvae 100 m⁻³) at each station was calculated as the ratio between number of individuals and total volume filtered. The density of reef, mesopelagic and epipelagic taxa was analyzed concomitantly using type III multifactorial MANOVA. Note that conditions to apply such analysis are not optimal due, among others, to the unbalanced design and the low number of values. Fixed factors were seasons (summer and winter; $n = 21$ and 9, respectively), depth at the place of sampling (categorized in three classes: 0–100 m, 100–1000 m and 1000 m or more; $n = 12$, 5 and 13), sampling time (day and night; $n = 15$ and 15), environment type (three classes: seamount, island and deep ocean between seamounts and island; $n = 17$, 8 and 5) and position according distance of the continental shelf (in the following order: Vitória, Montague, Jaseur, Davis, Dogaressa, Dogaressa-Columbia, Columbia, Columbia-Trindade, Trindade Island and Martin Vaz Archipelago; $n = 5$, 1, 4, 2, 3, 2, 2, 3, 4 and 4). Density data were log-transformed [$\ln(x+1)$] prior to analysis, and homogeneity of variance checked by Levene test. A stepwise removal of least-significant variables ($\alpha = 0.05$) was performed to optimize the available number of degrees of freedom ($df = 29$) to the high number of df used (only main effects were included; $df = 15$). MANOVA results indicated if the larval categories relative to the habitat of adults responded differently in respect to the independent variables inserted in the model. The best MANOVA model was further explored with ANOVAs for each dependent variable (density of reef, epipelagic and mesopelagic larvae) using MANOVA-selected explanatory variables. *A posteriori* Tukey HSD tests were applied in order to detect differences between categories. All MANOVA and ANOVA tests were run on IBM SPSS Statistic Version 20.0.

RESULTS

Almost four thousand (3,897) larvae were collected in summer and that were distributed in 159 taxa identified at the family ($n = 44$), genus ($n = 33$) or species level ($n =$

82) (Table 1). Due to their poor condition or because they were in the early stages of ontogenetic development, 13.3% of larvae were not identified but classified into 38 morphogroups (UNID, i.e., unidentified). In the winter, 1,026 larvae belonging to 61 taxa were collected and identified at the family level (19), genus (17) or species (25) level. Only one winter taxon was classified as UNID.

Mesopelagic larvae were the most abundant at all locations, except for Vitória (Figure 2). Myctophidae and Gonostomatidae represented, respectively, 27 and 13% of total larvae in summer and Myctophidae remained the most abundant family in winter (34%) (Table 1). The family Scombridae (7% of total larvae) and the species *Ranzania laevis* (Pennant, 1776) (1%) were the most abundant epipelagic taxa in summer while the species *Gempylus serpens* Cuvier, 1829 was the most common (6%) in winter. Holocentridae (23% of total), Labridae (4%) and Serranidae (2%) were the most abundant reef taxa in summer while in winter Serranidae (18%) and Pomacanthidae (5%) dominated. About 99% of Holocentridae were collected on Vitória seamount in two summer stations. Mesopelagic larvae had the highest number of taxa at all locations (Figure 3) except at Vitória (in the two seasons) and at Davis (in winter) where reef larvae were the most diverse.

The stepwise MANOVA testing the density of reef, epipelagic and mesopelagic taxa was significant (Pillai's Trace test; $P < 0.001$) when including season (Wilks' Lambda: $P < 0.001$) and environment type ($P = 0.01$). (The categorical variables depth at the place of sampling—amplly redundant with environment type—sampling time and distance from the continental shelf were not significant and removed from the model.) Thus, the three larval categories based on adult habitat behave differently in respect to the explanatory variables. Reef taxa were significantly more abundant over seamounts than in open ocean locations (ANOVA, Tukey post-hoc test; $P = 0.021$) while epipelagic larvae were significantly more abundant near islands ($P = 0.03$) and over seamounts ($P = 0.043$) than far from such geological structures (Table 2). The density of epipelagic taxa was higher in the summer ($P < 0.001$; Table 2).

DISCUSSION

Mesopelagic larvae numerically dominate the VTC ichthyoplankton community with no discernible variation in space or time. On the other hand, reef and epipelagic larvae appear dependent upon the presence of relief (seamounts or islands) and larval density of epipelagic taxa peaked in summer, likely in response to reproduction. The fish larvae community composition observed over the Vitória-Trindade chain is similar to those described for other regions of the tropical and subtropical southwestern Atlantic (Katsuragawa and Matsuura 1990; Ekau et al. 1999; Nonaka et al. 2000; Bonecker et

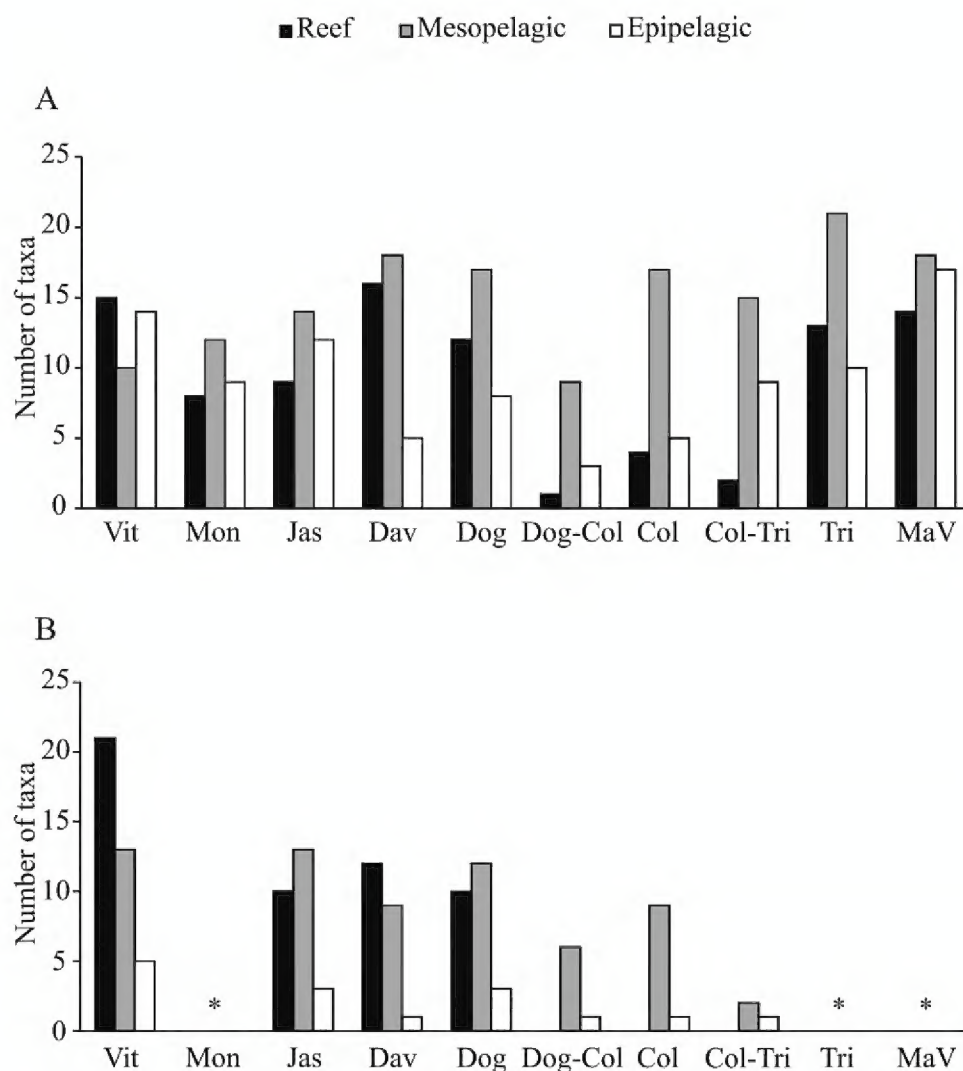


Figure 2. Density (individuals·100 m⁻³) of reef, mesopelagic and epipelagic taxa collected along the Vitória-Trindade Chain in summer (A) and in winter (B) according to location (see Table 1 for abbreviations). *¹ Vertical axis in A was truncated; observed values are: Vit: 177 ind·100m⁻³; Dav: 106 ind·100m⁻³; Col: 118 ind·100m⁻³. *² Not sampled.

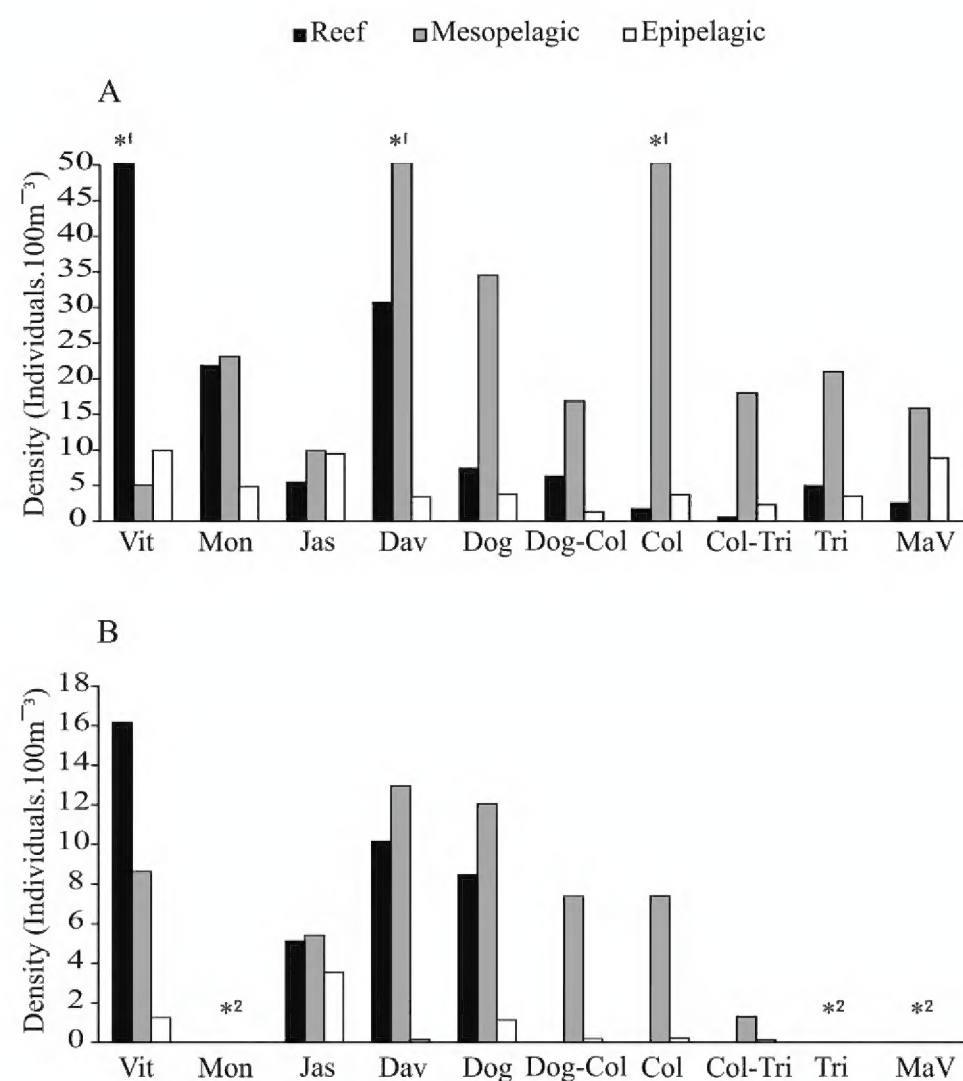


Figure 3. Number of reef, mesopelagic and epipelagic taxa collected along the Vitória-Trindade Chain in summer (A) and in winter (B) according to location (see Table 1 for abbreviations). * Not sampled.

Table 1. Ichthyoplanktonic taxa of the Vitória-Trindade Chain. Percentage of individuals in relation to total captured, P(%) in summer (Su) and winter (Wi), occurrence in the seamounts and islands of VTC (● in summer and ♦ in winter) and adult habitat (AH). Families are presented in phylogenetic order (Nelson 2006) and species in alphabetical order. The family Labridae includes Scarinae (Westneat and Alfaro 2005). Occurrence: **Vit:** Vitória; **Mon:** Montague; **Jas:** Jaseur; **Dav:** Davis; **Dog:** Dogaressa; **Dog-Col:** between Dogaressa and Columbia seamounts; **Col:** Columbia; **Col-Tri:** between Columbia seamount and Trindade Island; **Tri:** Trindade Island; **MaV:** Martin Vaz Archipelago. **UNID:** not identified.

Taxa	P(%) Su	P(%) Wi	Vit	Mon	Jas	Dav	Dog	Dog-Col	Col	Col-Tri	Tri	MaV	AH
Moringuidae	0.03												
<i>Moringua edwardsi</i> (Jordan & Bollman, 1889)	0.03						●						Reef
Chlopsidae	0.03												
<i>Kaupichthys hyoproroides</i> (Strömman, 1896)	0.03						●						Reef
Muraenidae	0.05												
<i>Gymnothorax moringa</i> (Cuvier, 1829)	0.03					●							Reef
Unidentified	0.03										●		Reef
Nemichthyidae	0.03	0.09											
<i>Avocettina</i> sp.	0.03					●							Mesopelagic
Unidentified		0.09						♦					Mesopelagic
Gonostomatidae	13.37	2.04											
<i>Cyclothone acclinidens</i> Garman, 1899	1.9	0.29	♦	●	●	●	●	♦♦	●	●	●	●	Mesopelagic
<i>Cyclothone braueri</i> Jespersen & Tåning, 1926	0.03						●						Mesopelagic
<i>Cyclothone pseudopallida</i> Mukhacheva, 1964	0.05								●				Mesopelagic
<i>Cyclothone</i> sp.	11.31	1.46	♦♦	●	♦♦	●	♦♦	♦♦	♦♦	♦♦	●	●	Mesopelagic
<i>Diplophos taenia</i> Günther, 1873	0.05	0.29			♦				♦♦	●			Mesopelagic
<i>Gonostoma atlanticum</i> Norman, 1930	0.03						●						Mesopelagic
Sternoptychidae	1.77	7.89											
<i>Maurolicus stehmanni</i> Parin & Kobylansky, 1993	1.77	7.89	♦		♦	♦♦		♦♦	♦♦	●	●	●	Mesopelagic
Phosichthyidae	3.90	4.77											
<i>Vinciguerria nimbaria</i> (Jordan & Williams, 1895)	3.85	4.77	♦	●	♦♦	♦♦	♦♦	♦♦	●	●	●	●	Mesopelagic
<i>Vinciguerria poweriae</i> (Cocco, 1838)	0.05			●								●	Mesopelagic
Stomiidae	0.13	0.29											
<i>Bathophilus</i> sp.	0.03										●		Mesopelagic
<i>Melanostomias</i> sp.	0.05										●	●	Mesopelagic
Unidentified	0.08	0.29	♦			♦	●				●	●	Mesopelagic
Synodontidae	0.03	0.19											
<i>Synodus synodus</i> (Linnaeus, 1758)	0.03						●						Reef
<i>Synodus</i> sp.		0.19	♦										Reef
Evermannellidae	0.03	0.38											
<i>Evermannella melanoderma</i> Parr, 1928	0.05	0.09		●			♦				●		Mesopelagic
Unidentified		0.29	♦		♦								Mesopelagic
Paralepididae	0.28	0.87											
<i>Lestidium</i> sp.	0.03	0.49			●	♦	♦						Mesopelagic
<i>Lestrolepis intermedia</i> (Poey, 1868)	0.03				●								Mesopelagic
<i>Macroparalepis brevis</i> Ege, 1933	0.08	0.19					♦			●	●	●	Mesopelagic
<i>Stemonosudis intermedia</i> (Ege, 1933)	0.05									●			Mesopelagic
Unidentified	0.13	0.19	●	●	♦	●				●		●	Mesopelagic
Gigantactinidae	0.03												
Unidentified	0.03											●	Mesopelagic
Myctophidae	30.90	33.72											
<i>Benthoosema suborbitale</i> (Gilbert, 1913)	0.05								●				Mesopelagic
<i>Bolinichthys</i> sp.	0.18	1.55				♦♦	♦♦	●	♦	●			Mesopelagic
<i>Centrobranchus nigroocellatus</i> (Günther, 1873)	0.03						●						Mesopelagic
<i>Ceratoscopelus warmingii</i> (Lütken, 1892)	0.98	4.67	♦		♦♦	♦♦	♦♦	●	♦♦	●	●		Mesopelagic
<i>Ceratoscopelus</i> sp.	0.05						●						Mesopelagic
<i>Diaphus metopoclampus</i> (Cocco, 1829)	0.13				●	●						●	Mesopelagic
<i>Diaphus mollis</i> Tåning de, 1928	17.38	14.91	♦♦	●	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	●	●	Mesopelagic

Continued

Table 1. Continued.

Taxa	P(%) Su	P(%) Wi	Vit	Mon	Jas	Dav	Dog	Dog-Col	Col	Col-Tri	Tri	MaV	AH
<i>Diaphus</i> sp. (as in Richards 2006)	1.64	3.08	◆◆	●	◆◆	◆◆	◆◆	●	◆◆	●	●	●	Mesopelagic
<i>Hygophum macrochir</i> (Günther, 1864)	0.03											●	Mesopelagic
<i>Hygophum taaningi</i> Becker, 1965	0.03										●		Mesopelagic
<i>Hygophum</i> sp.	0.18	0.19							◆◆				Mesopelagic
<i>Lampadena</i> sp.	0.56	0.39	◆	●	●	●			●			●	Mesopelagic
<i>Lampanyctus nobilis</i> Tåning de, 1928	0.05				●								Mesopelagic
<i>Lepidophanes gausi</i> (Brauer, 1906)	2.31	3.12	◆◆		◆◆	●	◆◆	●	◆◆	●	●	●	Mesopelagic
<i>Lepidophanes guentheri</i> (Goode & Bean, 1896)	1.39	4.97	◆◆	●	◆◆	◆◆	◆◆		●		●	●	Mesopelagic
<i>Lepidophanes</i> sp.	0.05						●						Mesopelagic
<i>Lobianchia dofleini</i> (Zugmayer, 1911)	0.03						●						Mesopelagic
<i>Myctophum obtusirostre</i> Tåning, 1928	0.03				●								Mesopelagic
<i>Nannobranchium atrum</i> (Tåning, 1928)	0.05					●							Mesopelagic
<i>Nannobranchium</i> sp.	0.03										●		Mesopelagic
<i>Notoscopelus caudispinosus</i> (Johnson, 1863)		0.09			◆								Mesopelagic
Myctophidae 1	5.11		●	●	●	●	●	●	●	●	●	●	Mesopelagic
Myctophidae 2	0.05		●								●		Mesopelagic
Myctophidae 3	0.08			●					●		●		Mesopelagic
Myctophidae 4	0.05					●						●	Mesopelagic
Myctophidae 5	0.08					●					●		Mesopelagic
Myctophidae 6	0.03								●				Mesopelagic
Myctophidae 7	0.05									●			Mesopelagic
Myctophidae 8	0.03									●			Mesopelagic
Myctophidae 9	0.28									●	●		Mesopelagic
Radiicephalidae	0.03												
Unidentified	0.03											●	Mesopelagic
Trachipteridae	0.05												
<i>Trachipterus trachipterus</i> (Gmelin, 1789)	0.03						●						Mesopelagic
<i>Zu cristatus</i> (Bonelli, 1819)	0.03											●	Mesopelagic
Bregmacerotidae		0.09											
<i>Bregmaceros atlanticus</i> Goode & Bean, 1886		0.09				◆							Mesopelagic
Ophidiidae	0.13	0.09											
<i>Spectrunculus grandis</i> (Günther, 1877)	0.03								●				Mesopelagic
Unidentified	0.11	0.09	◆◆			●				●			Mesopelagic
Ceratiidae	0.03												
<i>Cryptopsaras couesii</i> Gill, 1883	0.03	0.09									●		Mesopelagic
Unidentified		0.09			◆								Mesopelagic
Belonidae	0.05												
Unidentified	0.05										●	●	Epipelagic
Exocoetidae	0.56												
<i>Cheilopogon exsiliens</i> (Linnaeus, 1771)	0.10				●		●	●		●			Epipelagic
<i>Cheilopogon furcatus</i> (Mitchill, 1815)	0.03											●	Epipelagic
<i>Exocoetus volitans</i> Linnaeus, 1758	0.15				●						●	●	Epipelagic
<i>Exocoetus</i> sp.	0.08				●			●				●	Epipelagic
Unidentified	0.20									●		●	Epipelagic
Hemiramphidae	0.08												
Unidentified	0.08		●	●								●	Epipelagic
Trachichthyidae	0.03												
Unidentified	0.03									●			Mesopelagic
Holocentridae	23.25	0.48											
Unidentified	23.25	0.48	◆◆		◆	●	●	●				●	Reef
Syngnathidae	0.05	0.09											
<i>Amphelikturus dendriticus</i> (Barbour, 1905)	0.03					●							Reef
<i>Micrognathus crinitus</i> (Jenyns, 1842)	0.03					●							Reef
Unidentified		0.09	◆										Reef
Aulostomidae	0.03												
<i>Aulostomus strigosus</i> Wheeler, 1955	0.03											●	Reef

Continued

Table 1. Continued.

Taxa	P(%) Su	P(%) Wi	Vit	Mon	Jas	Dav	Dog	Dog- Col	Col	Col-Tri	Tri	MaV	AH
Fistulariidae	0.03												
<i>Fistularia petimba</i> Lacepède, 1803	0.03			•									Reef
Dactylopteridae	0.21												
<i>Dactylopterus volitans</i> (Linnaeus, 1758)	0.21		•		•								Reef
Scorpaenidae	0.44	0.29											
Unidentified	0.44	0.29	•♦	•	•	•	•					•	Reef
Serranidae	1.54	18.21											
<i>Anthias</i> sp.	0.05	0.09	•				•♦						Reef
<i>Epinephelus</i> sp.	0.03		•										Reef
<i>Liopropoma carmabi</i> (Randall, 1963)	0.15			•			•						Reef
<i>Pseudogramma gregoryi</i> (Breder, 1927)	0.13			•			•					•	Reef
<i>Serranus</i> sp.	0.44	18.12	•♦		♦	•♦	•♦				•	•	Reef
Serranidae 1	0.15					•							Reef
Serranidae 2	0.46					•							Reef
Unidentified	0.13		•		•				•		•		Reef
Opistognathidae	0.08	1.17											
<i>Opistognathus aurifrons</i> (Jordan & Thompson, 1905)	0.08										•		Reef
Unidentified		1.17	♦			♦	♦						Reef
Apogonidae	0.26	3.21	♦		♦	♦	♦						
<i>Apogon</i> sp.	0.15	2.83			♦	♦•	♦					•	Reef
<i>Phaeoptyx</i> sp.	0.03	0.38	♦				•						Reef
Unidentified	0.08					•					•		Reef
Epigonidae	0.03												
Unidentified	0.03									•			Reef
Coryphaenidae	0.10	0.48											
<i>Coryphaena equiselis</i> Linnaeus, 1758	0.10	0.39	♦♦		♦					•		•	Epipelagic
<i>Coryphaena hippurus</i> Linnaeus, 1758		0.09			♦								Epipelagic
Echeneidae	0.13												
<i>Echeneis naucrates</i> Linnaeus, 1758	0.08											•	Epipelagic
Unidentified	0.05						•	•					Epipelagic
Carangidae	0.98	2.43											
<i>Caranx</i> sp.	0.31		•										Reef
<i>Decapterus macarellus</i> (Cuvier, 1833)	0.13	2.04	♦•		♦	♦	♦						Reef
<i>Oligoplites saurus</i> (Bloch & Schneider, 1801)	0.03				•								Reef
<i>Pseudocaranx dentex</i> (Bloch & Schneider, 1801)	0.05		•										Reef
<i>Selar crumenophthalmus</i> (Bloch, 1793)	0.10	0.09	•				♦						Reef
<i>Seriola zonata</i> (Mitchill, 1815)	0.05		•										Reef
Unidentified	0.31	0.29	♦•			•						•	Reef
Bramidae	0.03												
Unidentified	0.03		•										Epipelagic
Lutjanidae	0.23												
<i>Lutjanus</i> sp.	0.18										•		Reef
Unidentified	0.05											•	Reef
Mullidae	0.26	3.70											
Unidentified	0.26	3.70	•♦			♦	♦						Reef
Chaetodontidae		0.09											
Unidentified		0.09	♦										Reef
Pomacanthidae	0.15	5.06											
<i>Centropyge</i> sp.	0.03										•		Reef
<i>Holacanthus tricolor</i> (Bloch, 1795)	0.10	2.53	♦		♦		•		•			•	Reef
Unidentified	0.03	2.53	•♦		♦	♦							Reef
Cirrhitidae	0.08												
<i>Amblycirrhitus pinos</i> (Mowbray, 1927)	0.08			•	•								Reef
Pomacentridae	0.26	0.58											
<i>Chromis</i> sp.	0.03	0.29	♦						•				Reef
<i>Microspathodon chrysurus</i> (Cuvier, 1830)	0.08										•	•	Reef
<i>Stegastes</i> sp.	0.10		•			•				•		•	Reef
Unidentified	0.05	0.29	♦			•♦							Reef

Continued

Table 1. Continued.

Taxa	P(%) Su	P(%) Wi	Vit	Mon	Jas	Dav	Dog	Dog- Col	Col	Col-Tri	Tri	MaV	AH
Labridae	3.95	3.39											
<i>Cryptotomus roseus</i> Cope, 1871	1.57	2.04	◆	●	◆◆	◆◆	◆◆						Reef
<i>Doratonotus megalepis</i> Günther, 1862	0.41	0.09	◆◆			●							Reef
<i>Halichoeres</i> sp.	0.03										●		Reef
<i>Scarus</i> sp.	0.05	0.29		●	◆		◆					●	Reef
<i>Sparisoma</i> sp.	1.18	0.39	◆	●	●		◆						Reef
<i>Xyrichtys</i> sp.	0.03										●		Reef
Unidentified	0.70	0.58	◆		●	◆◆					●	●	Reef
Chiasmodontidae	0.05												
<i>Kali macrura</i> (Parr, 1933).	0.03											●	Mesopelagic
<i>Pseudoscopelus</i> sp.	0.03								●				Mesopelagic
Gobiesocidae	0.13												
Unidentified	0.13										●		Reef
Callionymidae		0.09											
<i>Callionymus bairdi</i> Jordan, 1888		0.09				◆							Reef
Gobiidae	1.08												
<i>Coryphopterus</i> sp.	0.18					●					●	●	Reef
<i>Elacatinus</i> sp.	0.08					●							Reef
<i>Gnatholepis thompsoni</i> Jordan, 1904	0.03						●						Reef
<i>Lythrypnus</i> sp.	0.18										●		Reef
Unidentified	0.62						●				●	●	Reef
Ptereleotridae	0.18	1.36											
<i>Ptereleotris randalii</i> Gasparini, Rocha & Floeter, 2001	0.18	1.36	◆			◆◆	◆						Reef
Sphyraenidae	0.33	0.68											
<i>Sphyraena barracuda</i> (Edwards, 1771)	0.08	0.09	●				◆◆				●		Epipelagic
<i>Sphyraena guachancho</i> Cuvier, 1829	0.05				●								Epipelagic
<i>Sphyraena picudilla</i> Poey, 1860	0.10	0.48	◆				●					●	Epipelagic
<i>Sphyraena</i> sp.	0.10	0.09	◆◆	●	●						●		Epipelagic
Gempylidae	0.51	5.94											
<i>Gempylus serpens</i> Cuvier, 1829	0.51	5.94	◆◆	●	◆◆		◆		◆◆	◆◆	●	●	Epipelagic
Scombridae	6.85	0.68											
<i>Acanthocybium solandri</i> (Cuvier, 1832)	0.05			●								●	Epipelagic
<i>Euthynnus alletteratus</i> (Rafinesque, 1810)	0.08		●									●	Epipelagic
<i>Katsuwonus pelamis</i> (Linnaeus, 1758)	0.90	0.29	◆◆	●	●	◆◆	●	◆		●	●		Epipelagic
<i>Scomber colias</i> Gmelin, 1789	0.03					●							Epipelagic
<i>Scomberomorus cavalla</i> (Cuvier, 1829)	0.05		●										Epipelagic
<i>Thunnus alalunga</i> (Bonnaterre, 1788)	3.08		●	●	●	●	●		●	●	●	●	Epipelagic
<i>Thunnus albacares</i> (Bonnaterre, 1788)	1.51		●	●	●	●	●		●	●	●	●	Epipelagic
<i>Thunnus obesus</i> (Lowe, 1839)	0.18		●	●	●							●	Epipelagic
<i>Thunnus</i> sp.	0.13	0.09					◆				●	●	Epipelagic
Unidentified	0.85	0.29	◆◆		●		●	●		●		●	Epipelagic
Istiophoridae	0.05												
<i>Makaira nigricans</i> Lacepède, 1802	0.03		●										Epipelagic
Unidentified	0.03				●								Epipelagic
Nomeidae	0.44												
<i>Cubiceps pauciradiatus</i> Günther, 1872	0.23			●									Mesopelagic
<i>Cubiceps</i> sp.	0.10					●							Mesopelagic
<i>Psenes cyanophrys</i> Valenciennes, 1833	0.10			●		●							Mesopelagic
Caproidae	0.03												
Unidentified	0.03						●						Reef
Bothidae	0.05												
<i>Bothus lunatus</i> (Linnaeus, 1758)	0.03										●		Reef
<i>Bothus ocellatus</i> (Agassiz, 1831)	0.03											●	Reef
Balistidae	0.41												
<i>Balistes capriscus</i> Gmelin, 1789	0.03				●								Reef
<i>Canthidermis sufflamen</i> (Mitchill, 1815)	0.03				●								Reef

Continued

Table 1. Continued.

Taxa	P(%) Su	P(%) Wi	Vit	Mon	Jas	Dav	Dog	Dog- Col	Col	Col-Tri	Tri	MaV	AH
<i>Xanthichthys ringens</i> (Linnaeus, 1758)	0.30		•		•	•							Reef
Unidentified	0.10					•						•	Reef
Monacanthidae	0.10	0.09											
<i>Monacanthus ciliatus</i> (Mitchill, 1818)	0.08		•			•							Reef
Unidentified	0.03	0.09			♦	•							Reef
Ostraciidae	1.21												
Unidentified	1.21		•	•	•	•	•	•				•	Reef
Tetraodontidae	0.18	0.09											
<i>Sphoeroides</i> sp.		0.09			♦								
Unidentified	0.18			•			•			•	•	•	Reef
Diodontidae	0.15	0.09											
Unidentified	0.15	0.09	♦ •						•	•		•	Reef
Molidae	1.49												
<i>Ranzania laevis</i> (Pennant, 1776)	1.49		•	•	•	•	•		•	•	•	•	Epipelagic
Unidentified	3.13												
UNID 1	0.03		•										
UNID 2	0.03		•										
UNID 3	0.03		•										
UNID 4	0.03		•										
UNID 5	0.13		•								•		
UNID 6	0.03		•										
UNID 7	0.03		•										
UNID 8	0.03		•										
UNID 9	0.08			•	•								
UNID 10	0.03				•								
UNID 11	0.05					•							
UNID 12	0.03					•							
UNID 13	0.08					•							
UNID 14	0.05					•							
UNID 15	0.03						•						
UNID 16	0.03						•						
UNID 17	0.03							•					
UNID 18	0.03								•				
UNID 19	0.64								•	•	•	•	
UNID 20	0.13									•	•		
UNID 21	0.05									•			
UNID 22	0.03										•		
UNID 23	0.03										•		
UNID 24	0.28										•	•	
UNID 25	0.10										•		
UNID 26	0.41										•		
UNID 27	0.05										•		
UNID 28	0.03										•		
UNID 29	0.26										•		
UNID 30	0.18												
UNID 31	0.05											•	
UNID 32	0.03											•	
UNID 33	0.03											•	
UNID 34	0.03											•	
UNID 35	0.03											•	
UNID 36	0.03											•	
UNID 37	0.03											•	
UNID 38	0.03											•	
UNID 39		1.07	♦										

Table 2. Summary of ANOVAs results for ichthyoplankton density along the VTC according to season (summer and winter) and type of environment (seamount, island or open ocean). Ichthyoplankton is categorized according to the habitat used by adults. Superscript letters indicate homogeneous groups (Tukey test) from higher (a) to lower (b) mean. The variables depth, sampling time and position according to distance of the continental shelf were not included because they were not significant in the MANOVA.

Source	Adult Habitat					
	Reef		Mesopelagic		Epipelagic	
	F-value	P-value	F-value	P-value	F-value	P-value
Model	4.471	0.012	1.353	0.279	12.433	<0.001
Season	3.719	NS	2.694	NS	24.137	< 0.001
	–		–		Summer ^a Winter ^b	
Environment type	5.907	0.008	0.126	NS	3.498	0.045
	Seamounts ^a Islands ^{a,b} Open ocean ^b		–		Islands ^a Seamounts ^a Open ocean ^b	

al. 2006). However, it differs from the ichthyoneuston communities of St. Paul's Rocks (Macedo-Soares et al. 2012), the Fernando de Noronha Chain and the North Brazilian Chain (Lessa et al. 1999) likely due to sampling depth and the specificity of the ichthyoplankton compartment targeted by these studies. Only the family Holocentridae has not been reported among the most abundant reef taxa of the VTC and adjacent areas (Ekau et al. 1999; Nonaka et al. 2000; Bonecker et al. 2006). The seasonal variation observed in abundance of reef taxa is consistent with the reproductive season of the respective taxa (Jones et al. 2006; Kelly 2006; Richards et al. 2006a, 2006b).

Seamounts cause deviations of flow that may result in upwelling currents, vortices, and Taylor cones/columns, which can lead nutrients, and possibly organisms, from the deep ocean toward the surface, promoting increased primary productivity and help to retain water masses over the top of seamount summit (White and Mohn 2002). Using numerical models, Lemos (2014) detected Taylor cones/columns above the summits of Vitória, Jaseur and Davis seamounts. These phenomena may contribute to the greater density of ichthyoplankton on seamounts compared to open ocean (Bonecker et al. 1992; Rezende et al. 2006; Table 2) and can extend to 30 km into the surrounding waters (Dower and Mackas 1996). Specifically, the high density of reef taxa could be related, among other factors, to their ability to remain on the reef through horizontal and vertical swimming oriented by smell, hearing and vision (Leis 2007).

Distance is an important biogeographical factor for, both, terrestrial and aquatic species. For example, the richness of terrestrial taxa on islands often decreases with distance from the nearest mainland (MacArthur and Wilson 1967), the diversity of pelagic fish species decreases with distance from seamounts (Morato et al. 2010) and the density of larvae of topographically associated species decreases with increasing distance of seamount from larger land masses (Boehlert and Mundy 1993). However, the density pattern was not observed in this study ($P > 0.05$ for the position according to the

distance from the continental shelf). Nevertheless, the first seamount of the chain, Vitória, showed the highest density in both summer and winter and, also, the second-highest (in summer) or highest (in winter) number of reef taxa. Besides its proximity to mainland, its large summit area extent probably enables higher recruitment from the coast, a higher diversity of environments (H.T. Pinheiro and E.F. Mazzei, comm. pers.) and therefore a higher richness of fish (MacArthur and Wilson 1967), acting as the first link between populations of the Brazilian coast, seamounts and remote islands.

Davis had the highest number of reef taxa in winter and the second highest density for reef taxa in both seasons (Figures 2 and 3). This seamount is characterized by its high structural complexity of large reefs (Jean-Christophe Joyeux, obs. pers.) and its ability to shelter a large number of species (Pinheiro et al. 2014). The seamount also has a truncated conical shape which favors the formation of a Taylor cone (or column, depending on water stratification; Lemos 2014) that promotes the retention of plankton and facilitates self-recruitment (Boehlert and Mundy 1993). The richness of reef fishes at the extremities of the chain, particularly remarkable at its eastern end (Figure 3), may be a result of the higher number of habitats available. The islands of Trindade and Martin Vaz are the only emerged locations of the chain. Therefore, they possess habitable depth ranges that are absent in the seamounts and that allow the persistence and self-recruitment of shallow-water species, including those of the intertidal zone. Currently, the VTC does not appear to act as stepping-stones for dispersal of shallow-water species (Simon et al. 2013), but the colonization of Trindade and Martin Vaz may have been facilitated by a process of stepping-stones during the Pleistocene glaciations. With the sea level 120 m below the current sea level, all seamounts were emerged during the last glacial maximum (e.g., Thomas et al. 2009) and therefore contained shallow-water habitat propitious to the settlement of these species (Simon et al. 2013; Macieira et al. 2015).

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LITERATURE CITED

- Aleman, F., L. Quintanilla, P. Velez-Belchí, A. García, D. Cortés, J. M. Rodríguez, M.L. Fernández de Puelles, C. González-Pola, and J.L. López-Jurado. 2010. Characterization of the spawning habitat of Atlantic Bluefin Tuna and related species in the Balearic Sea (western Mediterranean). *Progress in Oceanography* 86: 21–38. doi: [10.1016/j.pocean.2010.04.014](https://doi.org/10.1016/j.pocean.2010.04.014)
- Boehlert, G.W. and B.C. Mundy. 1993. Ichthyoplankton assemblages at seamounts and oceanic islands. *Bulletin of Marine Science* 53(2): 336–361.
- Bonecker, A.C.T. and M.S. Castro. 2006. Atlas de larvas de peixes da região central da Zona Econômica Exclusiva brasileira. Museu nacional, Rio de Janeiro: Série Livros/ Documentos REVIZEE Score Central. 214 pp.
- Bonecker, S.L.C., C.R. Nogueira, A.C.T. Bonecker, L.H.S. Santos, M.V. Reynier and D.R. Tenenbaum. 1992. Estudo hidrográfico e planctológico da região entre Cabo Frio (Rio de Janeiro) e o Arquipélago de Abrolhos (Bahia) – Brasil. *Nerítica* 7(1–2): 71–86.
- Bonecker, A.C.T., M.S. Castro, C. Namiki; F.T. Bonecker, F. B.A. G. Barros and W.M. Monteiro-Ribas. 2006. Ictioplâncton; pp. 141–159, in: Valentin, J. L. (ed.). *Características hidrobiológicas da região central da Zona Econômica Exclusiva brasileira* (Salvador, BA, ao Cabo de São Tomé, RJ). Brasília: Ideal gráfica e Editora.
- Castro, M.S. 2006. Variação espacial e temporal das larvas de peixes ao norte e ao sul do banco de Abrolhos e no entorno da Cadeia Vitória-Trindade. [Phd Thesis]. Rio de Janeiro: Universidade Federal do Rio de Janeiro. 158 pp.
- D'Alessandro, E.K., S. Sponaugle, J.K. Lopiz and R.K. Cowen. 2011. Larval ecology of great barracuda, *Sphyræna barracuda*, and other sphyrænids in the Strait of Florida. *Marine Biology* 158: 2625–2638. doi: [10.1007/s00227-011-1771-y](https://doi.org/10.1007/s00227-011-1771-y)
- Dower, J.F. and D.L. Mackas. 1996. "Seamount effects" in the zooplankton community near Cobb Seamount. *Deep-Sea Research* 43: 837–858. doi: [10.1016/0967-0637\(96\)00040-4](https://doi.org/10.1016/0967-0637(96)00040-4)
- Ekau, W., P. Westhaus-Ekau and C. Medeiros. 1999. Large scale distribution of fish larvae in the continental shelf waters off North-east Brazil. *Archive of Marine Research* 47(2/3): 183–200.
- Fahay, M. 1983. Guide to the stages of marine fishes occurring in the Western North Atlantic, Cape Hatteras to the Southern Scotian shelf. *Journal of Northwest Atlantic Fishery Science* 4: 3–423. doi: [10.2960/j.v4.a1](https://doi.org/10.2960/j.v4.a1)
- Franco, B.C. and J.H. Muelbert. 2003. Distribuição e composição do ictioplâncton na quebra de plataforma do sul do Brasil. *Atlântica* 25(1): 75–86.
- Freitas, D.M. and J.H. Muelbert. 2004. Ichthyoplankton distribution and abundance off southeastern and southern Brazil. *Brazilian Archives of Biology and Technology* 47(4): 601–612. doi: [10.1590/s1516-89132004000400014](https://doi.org/10.1590/s1516-89132004000400014)
- Froese, R. and D. Pauly. 2013. FishBase. Accessed at <http://www.fishbase.org>, December 2013.
- Gasalla, M.A., G. Velasco, C.L.D.B. Rossi-Wongtschowski, M. Haimovici and L.S.P. Madureira. 2007. Modelo de equilíbrio de biomassas do ecossistema marinho da região Sudeste-Sul do Brasil entre 100–1000 m de profundidade. São Paulo: Instituto Oceanográfico-USP / Série Documentos REVIZEE / Score Sul. 56 pp.
- Gasparini, J.L. and S.R. Floeter. 2001. The shore fishes of Trindade Island, western South Atlantic. *Journal of Natural History* 35: 1639–1656. doi: [10.1080/002229301317092379](https://doi.org/10.1080/002229301317092379)
- Huebert, K.B., S. Sponaugle. and R.K. Cowen. 2010. Predicting the vertical distributions of reef fish larvae in the Straits of Florida from environmental factors. *Canadian Journal of Fisheries and Aquatic Sciences* 67: 1755–1767. doi: [10.1139/F10-116#.VMB4VEff-80](https://doi.org/10.1139/F10-116#.VMB4VEff-80)
- Jones, D.L., M.R. Lara and W.J. Richards. 2006. Labridae: Wrasses; pp. 1835–1871, in: W.J. Richards (ed.). *Early stages of Atlantic fishes: an identification guide for the western central North Atlantic*. Florida: CRC Press.
- Katsuragawa, M. and Y. Matsuura. 1990. Comparison of diel and spatial distribution patterns of ichthyoplankton and ichthyoneuston in the Southeastern Brazilian Bight. *Boletim do Instituto Oceanográfico* 38(2): 133–146. doi: [10.1590/s1679-87591990000200003](https://doi.org/10.1590/s1679-87591990000200003)
- Katsuragawa, M., J.H. Muelbert and J.F. Dias. 2006. O ictioplâncton na região entre o Cabo de São Tomé (RJ) e o Chuí (RS); pp. 359–446, in: C.L.D.B. Rossi-Wongtschowski and L.S.P. Marureira (eds.). *O ambiente oceanográfico da plataforma continental do talude na região sudeste-sul do Brasil*. São Paulo: EDUSP.
- Kelly, S. 2006. Pomacanthidae: Angelfishes; pp. 1767–1785, in: W.J. Richards (ed.). *Early stages of Atlantic fishes: an identification guide for the western central North Atlantic*. Florida: CRC Press.
- Kimura, M. 1953. Stepping-stones model of population. *Annual Report of the National Institute of Genetics* 3: 62–63.
- Leis, J. M. 1991. The pelagic stage of reef fishes: the larval biology of coral reef fishes; pp. 183–230, in: P.F. Sale (ed.). *The ecology of fishes on coral reefs*. San Diego: Academic Press.
- Leis, J. M. 2007. Behaviour as input for modelling dispersal of fish larvae: behaviour, biogeography, hydrodynamics, ontogeny, physiology and phylogeny meet hydrography. *Marine Ecology Progress Series* 347: 185–193. doi: [10.3354/meps06977](https://doi.org/10.3354/meps06977)
- Lemos, A.T. 2014. Aspectos meteo-oceanográficos associados com a concentração de clorofila-a ao longo da Cadeia Vitória-Trindade. [Phd Thesis]. Universidade Federal do Espírito Santo. 133 pp.
- Lessa, R.P., P. Mafalda-Jr., R. Advíndula, R.B. Lucchesi, J.L. Bezerra-Jr., T. Vaske-Jr. and D. Hellebrandt. 1999. Distribution and abundance of ichthyoneuston at seamounts and islands off north-eastern Brazil. *Archive of Fishery and Marine Research* 47(2/3): 239–252.
- MacArthur, R.H. and E.O. Wilson. 1967. *The theory of island biogeography*. Princeton: Princeton University Press. 224 pp.
- Macedo-Soares, L.C.P., A.S. Freire and J.H. Muelbert. 2012. Small-scale spatial and temporal variability of larval fish assemblages at an isolated oceanic island. *Marine Ecology Progress Series* 444: 207–222. doi: [10.3354/meps09436](https://doi.org/10.3354/meps09436)
- Macieira, R.M., T. Simon, C.R. Pimentel and J.-C. Joyeux. 2015. Isolation and speciation of tidepool fishes as a consequence of Quaternary sea-level fluctuations. *Environmental Biology of Fishes* 98: 385–393. doi: [10.1007/s10641-014-0269-0](https://doi.org/10.1007/s10641-014-0269-0)
- Mather, F.J., J.M.J. Mason and A.C. Jones. 1995. *Historical document: life history and fisheries of Atlantic Bluefin Tuna*. Miami: National Oceanic and Atmospheric Administration. 174 pp.

- Matsuura, Y. and E. M. Kitahara. 1995. Horizontal and vertical distribution of anchovy *Engraulis anchoita* eggs and larvae off Cape Santa Marta Grande in southern Brazil. *Archive of Fishery and Marine Research* 42(3): 239–250.
- Morato, T., S.D. Hoyle, V. Allain and S.J. Nicol. 2010. Seamounts are hotspots of pelagic biodiversity in the open ocean. *Proceedings of the National Academy of Sciences* 107: 9707–9711. doi: [10.1073/pnas.0910290107](https://doi.org/10.1073/pnas.0910290107)
- Motoki, A., K.F. Motoki and D.P. Melo. 2012. Submarine morphology characterization of the Vitória-Trindade Chain and the adjacent areas, state of Espírito Santo, Brazil, based on the predicted bathymetry of the TOPO version 14.1. *Revista Brasileira de Geomorfologia* 13(2): 151–170.
- Nelson, J. S. 2006. *Fishes of the world*. Hoboken: John Wiley & Sons. 601 pp.
- Nonaka, R.H., Y. Matsuura and K. Suzuki. 2000. Seasonal variation in larval fish assemblages in relation to oceanographic conditions in the Abrolhos Bank region off eastern Brazil. *Fishery Bulletin* 98: 767–784.
- Pinheiro, H.T., J.-C. Joyeux and R.L. Moura. 2014. Reef oases in a seamount chain in the southwestern Atlantic. *Coral Reefs* 33: 1113. doi: [10.1007/s00338-014-1211-9](https://doi.org/10.1007/s00338-014-1211-9)
- Rezende, C.E., L. Andrade, M.S. Suzuki, B.C.M.T. Faro, A.S.M. Gonzalez and R. Paranhos. 2006. Hidroquímica; pp. 31–60, in: J. L. Valentin (ed.). *Características hidrobiológicas da região central da Zona Econômica Exclusiva brasileira* (Salvador, BA, ao Cabo de São Tomé, RJ). Brasília: Ideal Gráfica e Editora.
- Richards, W.J. 2006. *Early stages of Atlantic fishes: an identification guide for the western central North Atlantic*. Florida: CRC Press. 1824 pp.
- Richards, W.J., C.C. Baldwin and A. Röpke. 2006a. Serranidae: Sea basses; pp. 1225–1331, in: W.J. Richards (ed.). *Early stages of Atlantic fishes: an identification guide for the western central North Atlantic*. Florida: CRC Press.
- Richards, W.J., J. Lyezkowski-Shultz and M. Konieczna. 2006b. Holocentridae: squirrelfishes; pp. 1047–1050, in: W.J. Richards (ed.). *Early stages of Atlantic fishes: an identification guide for the western central North Atlantic*. Florida: CRC Press.
- Simon, T., R.M. Macieira and J.-C. Joyeux. 2013. The shore fishes of the Trindade–Martin Vaz insular complex: an update. *Journal of Fish Biology* 82: 2113–2127. doi: [10.1111/jfb.12126](https://doi.org/10.1111/jfb.12126)
- Thomas, A.L., G.M. Henderson, P. Deschamps, Y. Yokoyama, A.J. Mason, E. Bard, B. Hamelin, N. Durand and G. Camoin. 2009. Penultimate deglacial sea-level timing from uranium/thorium dating of Tahitian corals. *Science* 324: 1186–1189. doi: [10.1126/science.1168754](https://doi.org/10.1126/science.1168754)
- UNEP. 2012. Table 2. Description of areas meeting criteria for ecologically or biologically significant marine areas (EBSAs) in wider Caribbean and western Mid-Atlantic region; pp. 190–199, in: Conference of the parties to the convention on biological diversity, Eleventh meeting Hyderabad, India, 8–19 October 2012. Report of the Eleventh Meeting of the Conference of the parties to the convention on biological diversity, UNEP/CBD/COP/11: 288p. <http://www.cbd.int/doc/meetings/cop/cop-11/official/cop-11-35-en.pdf>
- Victor, B. 2012. Coral reef fish. Accessed at <http://coralreeffish.com>, December 2013.
- Westneat, M.W. and M.E. Alfaro. 2005. Phylogenetic relationships and evolutionary history of the reef fish family Labridae. *Molecular Phylogenetics and Evolution* 36: 370–390. doi: [10.1016/j.ympev.2005.02.001](https://doi.org/10.1016/j.ympev.2005.02.001)
- White, M. and C. Mohn. 2002. *Seamounts: a review of physical processes and their influence on the seamount ecosystem*. Ireland: OASIS. 40 pp.
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